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Ways of Providing Pike Perch Larvae with the Necessary Food in the First Stages of Active Feeding

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WAYS OF PROVIDING PIKE PERCH LARVAE WITH THE NECESSARY FOOD IN THE FIRST STAGES OF ACTIVE FEEDING

[Puti obespecheniya lichinok sudaka neobkhodimym kormom na pervykh etapakh aktivnogo pitaniya]

by

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One of the important conditions of successful growing of young pike perch in spawning-breeding hatcheries is provision of the necessary feed to the fish in the first stages of active feeding.

A critical event, which determines the population of the young in a reservoir is the transition to active feeding. Therefore, "the presence of the appropriate food base in the initial period of active feeding, when the larvae still do not have the ability to change to another type of food, is particularly important" (Cherfas, 1956).

The natural food base of the spawning-breeding hatcheries of the Don

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is inadequate, and it cannot always provide the pike perch larve with the necessary food, especially at the time of change to active feeding. In connection with this, measures must be carried out to increase the food base of the reservoirs.

For this purpose, in 1958, the Azov Scientific Research Institute of the Fishing Industry proposed the use of reserve spawning ponds of the Uzyaksk Fish Hatchery, for growing zooplankton in them, with subsequent discharge into the reservoir.

At the Uzyaksk Fish Hatchery, there are 22 spawning ponds in the southern group and 10 spawning ponds in the northern group. The area of each spawning pond is 0.25 hectares, with an average depth of 0.5 m.

Pike perch spawning takes place in 6-10 spawning ponds (depending on the number of spawners). The remaining spawning ponds are flooded for the growth of zooplankton.

The pike perch larvae hatched from the eggs are kept in the spawning ponds until the change to active feeding, after which they are released into the growing pond. At this time, the reserve spawning ponds are drained, and the zooplankton from them enter the shallow water growing pond, together with the larvae. Up to the end of the second 10 days of May (while the pike perch larvae are kept in the shallow water), 3 or 4 discharges of zooplankton from the reserve spawning ponds take place.

Material and Methods

The results of a 3-year observation (1960-1962) are presented in the present work.

Hydrobiological samples were taken every 3-5 days, in the shallows of the reservoir and in the spawning ponds.

Moreover, hydrobiological samples were taken in the shallow water before and after draining the reserve spawning ponds.

In taking the plankton samples, 20 or 50 ℓ of water was strained through a No. 61 gauze plankton net. The samples were processed, in accordance with the instructions of the All-Union Scientific Research Institite of Sea Fishery and Oceanography. Standard weights of plankton organisms were used, in calculation of the zooplankton biomass (A. F. Zinov'yev, 1947; N. N. Kharin, 1948; F. D. Mordukhay-Boltovskoy, 1954).

As a result of the shallow water nature of the spawning ponds and their good heatability, zooplankton, which do not differ qualitatively from the zooplankton of the shoals, and which even considerably exceeded it in number of organisms and biomass, grow quickly and in large numbers in them. Thus, in May 1960, the zooplankton biomass in the spawning ponds was 18 times greater than in the reservoir (18 g/m^3 vs. 1 g/m^3). To increase the zooplankton biomass in the spawning ponds, green fertilizer (sheaves of sour, coarse vegetation) can be used.

The number of organisms and biomass of the zooplankton in the spawning ponds fluctuate considerably from year to year (Table 1).

Since discharge of the zooplankton from the spawning ponds occurs mainly in May, for clearness, data are presented on the number and biomass of zooplankton for this month alone (Table 1).

TABLE 1. TOTAL NUMBER OF ORGANISMS AND THEIR BIOMASS IN UZYAKSK FIGH HATCHERY SPAWNING PONDS IN MAY

a Группа зоопланктона	b Количество организмов, тыс. шт/м³			c Биомасса зоопланктона, г/м³		
	1960	1961	1962	1960	1961	1962
d Коловратки	81,4	529,4	32,7	0,1	0,2	0,1
e Кладоцеры	97,9	74,0	488,7	17,2	10,4	38,1
f Копеподы	165,8	399,4	115,4	1,5	2,2	0,8
g Всего . . .	345,1	1002,8	636,8	18,8	12,8	39,0

Key: a. zooplankton group
b. number of organisms, $10^3/m^3$
c. zooplankton biomass, g/m^3
d. Rotifera
e. Cladocera
f. Copepoda
g. total

[Translator's note: commas in tabulated figures are equivalent to decimal points.]

Data on the number and biomass of food organisms are presented in Table 2.

TABLE 2. NUMBER OF FOOD ORGANISMS AND THEIR BIOMASS IN UZYAKSK FISH HATCHERY SPAWNING PONDS IN MAY

a Группы зоопланктона	b Количество организмов, тыс. шт/м³			c Биомасса зоопланктона, г/м³		
	1960	1961	1962	1960	1961	1962
d Коловратки	81,4	529,4	32,7	0,1	0,2	0,1
e Мелкие кладоцеры	9,0	47,9	266,4	0,2	0,8	6,5
f Мелкие копеподы	162,2	361,2	108,5	1,0	0,9	0,3
g Итого . . .	252,6	938,5	407,6	1,3	1,9	6,9

Key: a. zooplankton group
b. number of organisms, $10^3/m^3$
c. zooplankton biomass g/m^3
d. Rotifera
e. small Cladocera
f. small Copepoda
g. total

It is seen from Table 2 that, in 1960 and 1961, the leading group of plankton (by number and biomass) was small copepods.[1] In 1962, the small Cladocera occupied first place among the plankton.

Depending on which group of zooplankton predominated in the spawning ponds, this same group was the leading one in the shallow water of the growing pond, as well as in the food of the pike perch larvae (which will be discussed below).

As was noted above, after draining of the reserve spawning ponds, the zooplankton biomass in the shallow water increases considerably.

Good results were obtained in 1960. The data for this year are presented in Table 3.

TABLE 3. ZOOPLANKTON BIOMASS IN SHALLOW WATER OF SOUTHERN RESERVIOR IN 1960

a Дата спуска нерестовиков	b Биомасса зоопланктона, г/м³	
	c перед спуском нерестовиков	d после спуска нерестовиков
6/V	0,3	4,5
13–16/V	1,5	7,4
21/V	1,0	2,6

Key: a. spawning pond draining date
b. zooplankton biomass, g/m³
c. before draining spawning ponds
d. after draining spawning ponds

[Translator's note: Roman numerals indicate months.]

As is seen from Table 3, after draining the spawning ponds, the zooplankton biomass in the shallow water increased 2.6-15 times.

On 12 May 1961, 15 spawning ponds (of 32) were not completely drained, in connection with stocking spawning carp in them. The spawning ponds not free of spawning carp could not be completely drained, since the water level in the spawning ponds, in which the carp were stocked, dropped, with

*The rotifera were not used in the calculation, since they were not of significant importance in the feeding of the young pike perch.

decrease in water level in the main canal. In connection with this, the zooplankton biomass in the shallow water increased only 3 times, on the average, as a result of draining the spawning ponds.

It must also be considered that, in 1961, the zooplankton biomass in the spawning ponds was 1.5-3 times less than in 1960 and 1962 (see Table 1).

In 1962, after draining the spawning ponds for two days (4-5 May), the zooplankton biomass in the shallow water of the reservoir was 47 g/m^3. Further, despite draining the spawning ponds (7-9 May), the zooplankton biomass in the shallow water of the reservoir dropped sharply (to 3.8 g/m^3). The pike perch larvae, entering the shallow water together with the zooplankton, fed heavily and grew well (there were 12 organisms per intestine, on the average).

In all likelihood, this explains the drop in zooplankton biomass in the shallow water, despite the draining of the reserve spawning ponds.

In draining the spawning ponds on 15 and 24 May, the zooplankton biomass in the shallow water increased 2 and 5 times, respectively.

In May 1962, in the shallow water of the Southern reservoir and in the spawning ponds, small Cladocera predominated in the zooplankton, both in biomass and in number of organisms (Table 4).

It is seen from Table 4 that the composition of the zooplankton in the shoal water is determined by the composition of the zooplankton released from the spawning ponds. In the biotopes of the reservoir, where the spawning ponds could not have an effect, the biomass of small Cladocera in May was 2.5 times less than in the shoal water (0.6 g/m^3 vs. 1.5 g/m^3). It must also be considered that plankton in the shoal water were

heavily eaten by the pike perch larvae, 83-88% of the food of which consisted of small Cladocera.

TABLE 4. CHARACTERISTICS OF FOOD ZOOPLANKTON IN SHALLOW WATER OF SOUTHERN RESERVOIR AND SPAWNING PONDS IN MAY 1962.

a Группа зоопланктона	b Нерестовики		c Мелководье водохр.	
	биомасса кормового зоопланктона, d г/м³	количество кормовых организмов, e тыс. шт./м³	биомасса кормового зоопланктона, f г/м³	количество кормовых организмов, g тыс. шт./м³
f Коловратки	0,1	33,0	0,03	13
g Мелкие				
h кладоцеры	6,5	266,4	1,50	76
i копеподы	0,3	108,5	0,10	33
j Итого	6,9	407,9	1,63	122

Key: a. zooplankton group
b. spawning ponds
c. reservoir shoal water
d. food zooplankton biomass, g/m^3
e. number of food organisms, $10^3/m^3$
f. Rotifera
g. small
h. Cladocera
i. Copepods
j. total

Let us consider further, how much food needs to be provided the pike perch larvae, at the time of their change to active feeding.

As was noted above, one of the critical events in the lives of pike perch larvae is their change to active feeding. Therefore, a necessary condition in this period is to provide fish larvae with the appropriate food.

The favorite food of pike perch larvae is copepods. In the first stage of active feeding, the young pike perch prefer to feed on copepods in the nauplial and copepodite stages (Mordukhay-Boltovskoy, 1954).

With an insufficient number of opepods, the young pike perch feed on those forms which predominate in the plankton (Tanasiychuk et al., 1957).

In the Uzyaksk Fish Hatchery, the nature of the pike perch larvae food in the first stages of active feeding in 1961 and 1962 depended on the qualitative and quantitative composition of the zooplankton in the shallow water (Table 5).

TABLE 5. NUMBER OF FOOD ORGANISMS AND THEIR BIOMASS IN THE SHALLOW WATERS OF THE UZYAKSK FISH HATCHERY GROWING PONDS IN 1961-1962

a Группа зоопланктона	1960		1961		1962	
	b количество кормовых организмов, тыс. шт/м³	c биомасса кормовых организмов, г/м³	количество кормовых организмов, тыс. шт/м³	биомасса кормовых организмов, г/м³	количество кормовых организмов, тыс. шт/м³	биомасса кормовых организмов, г/м³
d Коловратки	37,6	0,07	42,1	0,09	13	0,03
e Мелкие						
f кладоцеры	2,1	0,05	36,8	0,68	76	1,50
g копеподы	85,3	0,60	54,9	0,11	33	0,10
h Итого	125,0	0,72	133,8	0,88	122	1,63

Key: a. zooplankton group
b. number of food organisms, $10^3/m^3$
c. food organism biomass, g/m^3
d. Rotifera
e. small
f. Cladocera
g. Copepoda
h. total

In the opinion of Mordukhay-Boltovskoy (1954), a copepod biomass of 0.5-1 g/m^3 is sufficient for normal feeding of young fish. Heavy feeding of the larvae and young of the pike perch was observed, with a food plankton biomass of 0.5-0.6 and even 0.3 g/m^3 (Mordukhay-Boltovskoy, 1954).

In the Uzyaksk Fish Hatchery in 1960, the food plankton biomass was 0.72 g/m^3, including a small copepod biomass of 0.6 g/m^3; the small copepods also predominated in the number of food organisms in the plankton. In the first stages of active feeding, small copepods constituted 91% of the pike perch food, and small Cladocera, 9% of the weight of the food lumps. Pike perch larvae, 6.5-8.5 mm long, fed 2.5 times more heavily in 1960, than larvae of the same sizes in 1959 (when the reserve spawning ponds were not used), and they changed from stage to stage with larger sizes.

Based on what has been stated above, it can be assumed that, in 1960, in the early stages of their growth, the young pike perch were provided with their favorite food to a sufficient extent.

In 1961, by number of organisms in the food plankton, small copepods predominated and, by biomass, small Cladocera. Despite the fact that the small Cladocera biomass was 6 times greater than the copepod biomass, the young pike perch preferred to feed on copepods, in the search for which they expended less energy, since their density was higher.

In 1961, in the first stages of active feeding of the young pike perch, their food consisted of 79% small copepods and 21% small Cladocera.

Considering the state of the food bioplankton in the shallow waters (low small copepod biomass, 0.1 g/m^3) and the nature of the pike perch larvae food, it can be concluded that the young pike perch, in the first stages of active feeding in 1961, were not provided with a sufficient amount of food.

The reason for this was incomplete drainage of the spawning ponds.

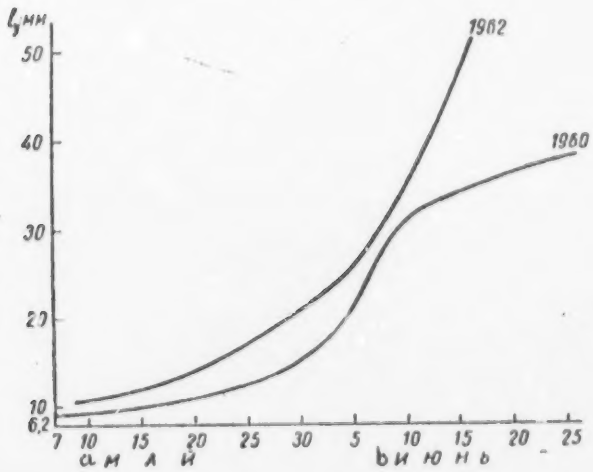
In 1962, in the shallow water, small Cladocera predominated in the food plankton, both by number of organisms and in biomass. The zooplankton food biomass in this year was twice that in 1960 and 1961.

In 1962, the food of the pike perch larvae in the first stages of active feeding consisted of 83-88% small Cladocera.

Although the favorite food of the pike perch in these stages is small copepods, in feeding on the Cladocera, the pike perch larvae grew rapidly. In 1962, the weight of a pike perch larvae food lump was 2.5 times greater than in 1960.

In 1961, because of exceptionally unfavorable conditions for pike perch spawning and egg incubation, great death of pike perch eggs and larvae took place in the spawning ponds. As a result, very few pike perch larvae were released from the spawning ponds into the reservoir. Therefore, we compare the 1960 and 1962 data.

In 1962, the young pike perch were of greater length and weight than in 1960, at approximately the same times (see figure).



Linear growth of young pike perch in Southern reservoir of Uzyaksk Spawning-Breeding Hatchery in 1960 and 1962.

Key: a. May
b. June

It is seen from the figure that, in 1962, the young pike perch grew better than in 1960. This was determined by heavier feeding. In the first stages of active feeding, the weight of a pike perch larvae food lump in 1962 was 1.9-2.7 times more than in 1960.

As a result of proper operation of the reserve spawning ponds in 1960 and 1962, the pike perch larvae, in the first stages of active feeding, were provided with the necessary food.

In 1960 and 1962, the weight of a pike perch larvae food lump was 2-5 times higher than in 1959 (when the reserve spawning ponds were not exploited).

Good feeding conditions in the initial period of growth promoted an increase in fish productivity in the reservoir (Table 6).

TABLE 6. GROWING OF YOUNG PIKE PERCH IN SOUTHERN RESERVOIR OF UZYAKSK SPAWNING-BREEDING HATCHERY

a Год	b Количество выращенной молоди, млн. шт.	c Средняя навеска	d Рыбопродуктивность, тыс. *шт./га*	d Рыбопродуктивность, тыс. *шт/га*
1959	0,023	0,5	0,023	0,07
1960	14,0	0,55	19,30	35,0
1962	0,5	1,4	1,81	1,29

Key: a. year
b. number of young produced, millions
c. average weight
d. fish productivity, 10^3/hectare

It is seen from Table 6 that the smallest fish productivity of the reservoir was in 1959.

The largest number of young was produced in 1960, and the fish productivity also was considerably higher than in other years.

At the start of growth of the young pike perch in 1962, conditions were favorable, the zooplankton food biomass was high, the pike perch larvae fed heavily, and there was still no coarse vegetation.

Conditions in the reservoir deteriorated sharply at the end of growth of the young pike perch. Solid thickets of coarse vegetation occupied almost all the area of the reservoir, and the collectors and eriks also became overgrown with coarse vegetation and, moreover, hairweed grew in them in bulk. Furthermore, as a result of construction of carp ponds, the deepest part of the reservoir, the Cherepashiy erik (depth 1.5-2 m, width about 30 m), was cut off from the remaining part of the reservoir. In the preceding year, the main bulk of the pike perch had been here, at later stages of growth. Thus, the usable area of the reservoir was sharply reduced, the young pike perch were completely deprived of favorable habitats and, besides that, at the end of the growth period of the young, a depression was observed in growth of the zooplankton. Great death of the young pike perch occurred in this period.

Thus, the low fish productivity in 1962 is explained by poor conditions in the reservoir, at the end of growth of the young pike perch and massive death of them in this period.

Conclusions

1. The use of reserve spawning ponds permits the food base to be increased, at the points of release of pike perch larvae, in the most critical stage of growth of the young, the change to active feeding.

2. Correct utilization of the reserve spawning ponds and their complete drainage in 1960 and 1962 permitted the pike perch larvae to be provided with the necessary food, at the first stages of active feeding.

3. In 1960 and 1962, the pike perch fed more heavily and had greater length and weight than in 1959, when the reserve spawning ponds were not used.

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